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The relations between implicit intelligence beliefs, autonomous academic motivation, and school persistence intentions: a mediation model

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Abstract This study attempts to test a model in which the relation between implicit theories of intelligence and students' school persistence intentions are mediated by intrinsic, identified, introjected, and external regulations. Six hundred and fifty students from a high school were surveyed. Contrary to expectations, results from ESEM analyses indicated that the four types of regulations do not mediate the relation between implicit theories of intelligence and students' intentions to persist in school. Rather, results show two direct effects, where an incremental theory of intelligence is associated with greater school persistence intentions, as well as being motivated in an intrinsic manner. In addition, results reveal that academic achievement is related to persistence intentions. No gender differences were observed. This research highlights the importance of promoting students' incremental intelligence beliefs and intrinsic motivation in order to foster school persistence intentions. Theoretical and practical implications for parents and teachers are discussed.

Keywords Implicit theories of intelligence · Motivation · School persistence intentions

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1 Introduction

According to the Education at a Glance 2013 report (OECD 2013), it is estimated that an average of 17 % of today's young people in OECD countries will not complete upper secondary education (students at this level are generally aged of 15 or 16 years) over their life. These statistics are alarming, because young people who do not complete upper secondary education are likely to experience higher unemployment rates (Rumberger 1995), to become dependent on public welfare (Morris et al. 1991; Rumberger 1987), to use addictive substances (Strom and Boster 2007), and to develop poor lifestyle habits along with health problems (Rumberger 1987). Previous research indicated that motivation is a factor in adolescents' intentions to persist in school (e.g., Bean 1985; Rumberger 1987; Tidwell 1988; Tinto 1975; Vallerand et al. 1997).

The goal of the present research is to study two categories of motivation factors, namely self-theories of intelligence (Dweck and Master 2009) and autonomous academic motivation (Ryan and Deci 2009) in relation to school persistence intentions. More precisely, based on self-determination theory (SDT; Deci and Ryan 2000; Ryan and Deci 2009), we examine whether types of academic motivation (i.e., intrinsic, identified, introjected, and external) mediate the relation between self-theories of intelligence and school persistence intentions. Testing these relations is important to extend our knowledge on the links among these constructs, especially during high school years where students face challenges and difficulties (Blackwell et al. 2007). To provide a rationale for this mediation hypothesis, we first describe Dweck's self-theories of intelligence, followed by SDT's types of motivation. In each description of the two theories, we review research conducted in the realm of school persistence. In this study, we used a relatively new statistical tool, namely exploratory structural equation modeling (ESEM), to test the mediation model. ESEM offers the possibility to integrate features of confirmatory factor analysis (CFA), structural equation modeling (SEM), and exploratory factor analysis (EFA) in a single framework. This statistical tool thus provides a relatively strong test of the proposed mediation model. Later, we provide a brief overview of ESEM.

1.1 Implicit theories of intelligence

Dweck's motivational model of achievement was developed to provide an understanding of the psychological resources that allow students to cope with sustained challenges and setbacks in an achievement context (Dweck and Leggett 1988). In other words, why do some students get discouraged when faced with difficulties, whereas others embrace them with confidence and persistence? Dweck's model postulates that different beliefs about the nature of intelligence shape children's responses to challenging tasks and setbacks (Blackwell et al. 2007; Dweck and Master 2009). An *incremental* theory of intelligence refers to the belief that intelligence is malleable and can be cultivated and changed over time, whereas an *entity* theory of intelligence refers to the belief that intelligence is a fixed trait and will not change over time (Dweck and Leggett 1988).

These self-theories lead to distinctive achievement goals, which in turn are expected to be associated with different motivational responses (Dweck and Master 2009). For

example, those espousing an entity theory tend to pursue *performance goals* in order to prove their ability and show that they are smarter than the others. They believe that their performance is a direct measure of their own ability. They thus prefer to engage in easy tasks that will prevent them from looking "dumb." In contrast, those who hold an incremental theory tend to pursue *learning goals* aimed at improving their ability for the sake of learning (Dweck and Bempechat 1983). Furthermore, a great deal of research has explored students' motivational responses when they encounter difficulties (Dweck et al. 1995). The research shows that those holding an incremental theory tend to respond in a mastery-oriented manner, making use of innovative strategies and exerting efforts along with a high degree of persistence. It has been found that those espousing an entity theory, on the other hand, are more likely to respond to challenge in a helpless manner, displaying negative affect, a lack of perseverance, and maladaptive coping reactions such as a desire to withdraw from the task (Dweck et al. 1995; Dweck and Master 2009).

Compared with elementary school, the high school years make many students struggle because of the challenging nature of classes, the increasing complexity of the tasks, and the greater amount of effort and hard work required to succeed (Dweck and Master 2009). Hence, this new school environment can be very demanding, and some students may eventually take the easy way out and choose to disengage from school (Eccles et al. 1993). In this study, we propose that students having an incremental theory of intelligence will have higher intentions to persist, whereas those having an entity theory will report lower intentions to persist. These relations will be explained by the types of regulation that both categories of students have developed. Below we explain in more details this mediation hypothesis.

1.2 Self-determination theory: the continuum of autonomy

People's motivation to act can vary from passive external compliance to active personal commitment. Self-determination theory (SDT; Ryan and Deci 2000) distinguishes between intrinsic and extrinsic motivation. *Intrinsic motivation* refers to the performance of an activity for its own sake, that is, for the inherent interest in the activity itself. *Extrinsic motivation* refers to the performance of an activity for instrumental reasons. SDT specifies different types of extrinsic motivation along a continuum, with each one reflecting a distinct level of self-determination (i.e., the extent to which a behavior is fully endorsed and chosen by an individual). These are external, introjected, identified, and integrated regulations. *Externally regulated* behaviors are performed to obtain a reward or to avoid a punishment. *Introjected regulation* occurs when persons perform a behavior but do not fully endorse it, therefore, acting out of guilt or shame or when they want to present to others a positive image of themselves. *Identified regulation* occurs when persons perform an activity out of choice that they consider to be personally meaningful and valued. This is considered an autonomous form of motivation, because the behavior is performed out of choice. Finally, *integrated regulation*[1]

[1] This form of regulation was not assessed in this study, because it applies more to individuals with a higher level of psychological development and a fully forged identity (Ratelle et al. 2007). SDT also considers

is the most autonomous form of extrinsic motivation and occurs when individuals have internalized core values and behaviors into their sense of self.

According to SDT, the motivation types can be ordered along a continuum. Motivation types are therefore expected to show a simplex like pattern of correlations, with stronger positive correlations between adjacent than distant motivations (Ryan and Connell 1989). The simplex concept (Guttman 1954) describes ordered relations between correlated variables such that those that share conceptual similarities (e.g., intrinsic and identified) correlate more highly than those that are more conceptually discrepant (e.g., intrinsic and external regulation). When a correlation matrix is arranged in a way that constructs with similar conceptual properties are next to each other, a perfect simplex model will show the largest correlations close to the diagonal and correlations below the diagonal should decrease (see Ryan and Connell 1989).

The most autonomous forms of motivation (intrinsic and identified regulations) have been reported to lead to a number of positive outcomes, in contrast to more controlled forms of motivation (external and introjected regulations), which have been found to induce negative outcomes (Ryan and Deci 2000). Past research in the realm of education has revealed that autonomous types of academic motivation are associated with better academic performance (Fortier et al. 1995; Vallerand et al. 1997; Ratelle et al. 2007) and greater school persistence (Ratelle et al. 2007; Vallerand and Bissonnette 1992; Vallerand et al. 1997). For instance, Vallerand and Bissonnette (1992) compared students' motivation to persist versus drop out of a first-year compulsory course at the College level (equivalent to 13th grade in the English educational system). They found that the students who completed the course had higher levels of intrinsic motivation and identified regulation than those who abandoned it. Furthermore, a study conducted by Vallerand et al. (1997) showed that a lack of autonomous motivation at school is associated with intentions to disengage from school, which in turn predict actual dropout behavior. In a similar study, Hardre and Reeve (2003) showed in a sample of rural students that those experiencing high levels of autonomous motivations at school were more likely to formulate persistence intentions over and beyond previous academic performance. In light of these results, it seems that motivation is an important predictor of future academic intentions to persist.

1.3 Self-theories of intelligence and autonomous motivation: possible links in the prediction of school persistence intentions

Research showed that self-theories of intelligence are related to distinct goals, learning opportunities, degree of effort, reaction to failure, and performance (see Dweck and Master 2009 for a review). Students with an entity theory of intelligence are less concerned with increasing their abilities, are less willing to put effort, and do not take advantage of opportunities to learn. But what does this mean for the regulation

Footnote 1 continued
amotivation, the relative absence of motivation (Ryan and Deci 2000). We did not assess this construct, because our interest was more oriented toward motivation itself than toward a lack of motivation.

of their behavior at school? Do students endorsing an entity theory regulate their behaviors differently from those holding incremental beliefs? Students holding an entity theory of intelligence should develop a regulation system in which controlled forms of motivation are more salient. Specifically, they are more likely to regulate their behaviors for introjected reasons (e.g., because I will feel bad about myself if I don't perform better than others) or external ones (e.g., because I want the teacher to think that I'm a good student). In contrast, students having an incremental theory of intelligence would be more likely to develop a regulation system in which autonomous types of motivation are more salient. That is, they are more prone to regulate their behaviors for intrinsic reasons (e.g., because I enjoy doing this learning activity) or identified ones (e.g., because it is important for me to understand the subject). Such distinctive relations were observed in a study designed to measure the motivation and self-perception profiles of female high-school students in the physical education domain (Biddle and Wang 2003). Results showed that students who had entity beliefs reported low levels of autonomous motivation, whereas those who had incremental beliefs had high levels of autonomous motivation (Biddle and Wang 2003; see also Wang et al. 2002).

1.4 Exploratory structural equation modeling to test hypotheses

Structural equation modeling (SEM) and confirmatory factor analysis (CFA) have been widely used to test various models. However, some tested SEM/CFA models fail to reach commonly accepted levels of fit to the data usually advocated in SEM/CFA research (see Marsh et al. 2009 for more details). For example, the factor structure of the Academic Motivation Scale (AMS), the instrument used to assess motivation in this study, failed to meet acceptable standards of fit (e.g., Hu and Bentler 1999) in most studies. The basic assumption behind CFA/SEM analysis is that items load on their respective factor (i.e. main loading), with no cross-loading on the other latent factors (Marsh et al. 2009). This procedure is consistent with the restrictive independent cluster model (ICM) of CFA/SEM, and it has the advantage of motivating researchers to develop parsimonious models. However, ICM-CFA/SEM requires strong measurement assumptions that do not always hold with the data.

Because types of motivation are supposed to form a continuum (simplex like pattern), it is reasonable to believe that manifest variables meant to measure one type of motivation could also be influenced, to some extent, by other latent variables. If this occurs, some cross-loadings would exist. For example, students who report that they attend school "because they really like going to school" might not only give this answer because of their intrinsic motivation, but also because of their identified motivation. Constraining a factor loading to 0 when its real value is different from 0, tends to bias other parameter estimates of the model (Asparouhov and Muthén 2009), notably path coefficients which are crucial estimates to test hypotheses. Therefore, in this study, we adjusted both a traditional SEM model to the data, in which all cross-loadings are constrained to zero as well as one with the ESEM approach. This last approach allows the exploration of all possible loadings connecting latent variables to a set of manifest variables, while still testing *potential* causal relation-

ships among variables (Asparouhov and Muthén 2009). Specifically, ESEM has the same advantages of a classical SEM/CFA, but takes into account the flexibility of exploratory factor analysis (EFA). Some misunderstanding exists regarding the difference between EFA/ESEM and CFA/SEM models. Specifically, some researchers consider EFA/ESEM as an exploratory method, whereas they see CFA/SEM as a confirmatory procedure. However, there is nothing inherently "exploratory" or "confirmatory" in either EFA/ESEM or CFA. Rather, the main difference between them is that all cross loadings are estimated in EFA/ESEM and not in CFA/SEM.

1.5 Hypotheses and contribution to existing knowledge

The present study sought to test the model illustrated in Fig. 1, in which students' type of motivation (i.e. intrinsic, identified, introjected, and external) mediates the relationship between self-theories of intelligence and persistence intentions. Gender and academic achievement were examined as controls because past research has shown that school performance is associated with intentions to drop out (Battin-Pearson et al. 2000), and that girls tend to have lower dropout intentions than boys (Royer et al. 1993; Vallerand et al. 1997). This study contributes to the existing knowledge in three ways. First, it will increase our knowledge of motivational factors that could explain why some students eventually develop school persistence intentions based on their self-theories of intelligence. Until now there have been few attempts to integrate hypotheses derived from these two frameworks. This could advance our understanding of the determinants of motivation types proposed by SDT as well as the consequences of self-theories of intelligence for human regulation. Alternatively, the test

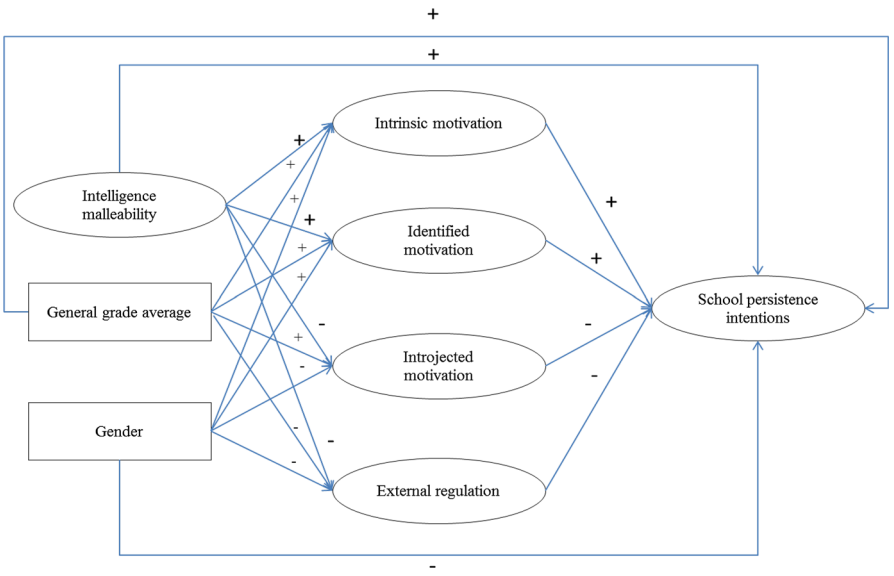

Fig. 1 Structural part of the hypothesized model

proposed here could reveal that these constructs are relatively independent, contributing to dropout intentions in an additive way. Second, we test these predictions in a sample of adolescents who are more prone to face challenges and difficulties and thus for which self-theories of intelligence might be more solicited (Blackwell et al. 2007). Third, we tested our research hypotheses using a relatively new sophisticated approach, namely ESEM. The present investigation could therefore be classified as a substantive methodological synergy study (Marsh and Hau 2007), in that we apply a sophisticated methodology to address a substantively important issue with significant practical implications.

2 Method

2.1 Participants and procedure

A total of 650 students from a French-speaking high school in suburban Montreal participated in this study. The sample was composed of 351 boys (54 %) and 299 girls (46 %). The mean age of the students was 14.86 years ($SD = 1.36$). The questionnaires were distributed at the end of February 2008. All students were given a consent form to be signed by their parents and returned to the school prior to the questionnaire administration. Students filled out the questionnaire on computers during class time and two well-trained research assistants were available to answer students' questions.

2.2 Measures

2.2.1 Academic achievement

Participants were asked to self-report their grade average of the autumn semester. One may be skeptical that self-report grades measure actual grades and achievement because students may under or over estimate them in various school subjects. However, Kuncel et al. (2005) found that high-school students estimate quite accurately their grades across various school subjects as the correlations were over 0.80 with objective achievement criteria.

2.2.2 Academic Motivation Scale

In this study we used an abridged version of The French version of the Academic Motivation Scale (AMS; Vallerand et al. 1989). This version was composed of 16 items measuring four types of motivation: intrinsic (e.g., "Because I experience pleasure and satisfaction while learning new things"), identified (e.g., "Because I think that education will help me better prepare for the career I have chosen"), introjected (e.g., "To show myself that I am an intelligent person"), and external (e.g., "To have a better salary later on"). Cronbach alpha values are 0.84, 0.73, 0.85, and 0.66 for intrinsic, identified, introjected, and external regulation respectively.

2.2.3 Implicit theories of intelligence

A scale developed by Henderson et al. (1992) was used to measure students' implicit theories of intelligence. This scale comprised three items assessing the extent to which students believe that intelligence is a fixed entity (1-"You have a certain amount of intelligence, and you really can't do much to change it"; 2-"Your intelligence is something about you that you can't change very much"; 3-"You can learn new things, but you can't really change your basic intelligence"). Responses were scored on a 7-point Likert-type scale ranging from 1 (*not at all in agreement*) to 7 (*totally in agreement*). We have recoded this scale in order to reflect levels of intelligence malleability. A higher score indicated a belief that intelligence is incremental or malleable, whereas a lower score indicated a belief that intelligence is fixed. This scale's internal consistency was 0.78.

2.2.4 Persistence in school

A scale adapted from Vallerand et al. (1997) was used to measure students' intentions to persist in school versus intentions to drop out. Students responded to the following statement: "I intend to drop out of school" on a 7-point Likert-type scale (1 = *completely in agreement, 7 = not at all in agreement*). Because there was little variability in the participants' intentions to drop out of school, we have broken the participants' answers into two categories. Participants who indicated that they are "*not at all in agreement-7*" or "*agreed very little-6*" (coded 1) were contrasted to those who answered 1, 2, 3, 4 or 5 (coded 0).

2.3 Statistical analyses

2.3.1 Estimation method

All structural equation modeling analyses were performed on polychoric correlation matrices using Mplus (version v5.21) with the WLSMV estimator for categorical variables. Because analysing only the complete cases would have resulted in lower statistical power (there is 25, 7% of missing observations in this study) and may cause potential bias in the results (Graham 2009), missing data were handled by the default Mplus procedure when using the WLSMV estimator. This procedure allows missingness to be a function of observed covariates, but not of the observed outcomes. This method is analogous to pairwise present analysis (Muthén and Muthén 2009). The choice to rely on WLSMV estimation is linked to the fact that this estimator is more suited to the ordered-categorical nature of Likert scales than traditional maximum likelihood estimation (Beauducel and Yorck Herzberg 2006; Finney and DiStefano 2006; Lubke and Muth'en 2004) as well because dropout intentions were measured dichotomously. SEM models were estimated according to the independent cluster model, with each item allowed to load on a single factor, and all seven factors allowed to correlate. ESEM models were estimated according to the specification provided in Asparouhov and Muthén (2009), with all rotated loadings freely estimated, subject to

typical constraints imposed on the unrotated factor solution for identification purposes. We used in this study a CF-Parsimax oblique rotation.

2.3.2 Goodness of fit

The fit of all models was evaluated using various indices as operationalized in Mplus in conjunction with the WLSMV estimator (Hu and Bentler 1999; Yu 2002). It is now broadly accepted that all a priori models are false and will be shown to be false when tested with a sufficiently large sample size. For this and other reasons, Chi-square tests of exact fit are of little relevance for evaluation of goodness of fit for a single model (e.g., Marsh et al. 1988). In applied CFA/SEM research, there is a predominant focus on approximate fit indices that are sample size independent (e.g., Hu and Bentler 1999; Marsh et al. 2004, 2005) such as the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). Values greater than 0.90 for CFI are considered to be indicative of adequate model fit, although values approaching 0.95 are preferable. Values smaller than 0.08 or 0.06 for the RMSEA support respectively acceptable and good model fit. Note that previous research has shown that traditional fit indices (CFI, RMSEA) perform well under WLSMV estimation (Beauducel and Yorck Herzberg 2006).

3 Results

3.1 Descriptive statistics

Of the 650 cases, 483 had no missing values (74.3 %). Means, standard deviations, and correlations are presented in Table 1. A very large majority of participants have little or no intentions of dropping out of school (89 %). Intelligence malleability, general grade average, intrinsic motivation, identified regulation, and introjected regulation are all positively and significantly correlated with school persistence intentions. However, the correlations are small, ranging from 0.10 to 0.25.

Table 1 Means, standard deviations, and intercorrelations between measures

	1	2	3	4	5	6	7	M	SD
1. General grade average	–							74.89	10.58
2. Gender	−0.18*	–						0.54	0.50
3. Intrinsic motivation	0.30*	−0.15*	–					2.75	0.93
4. Identified motivation	0.14*	−0.06	0.43*	–				4.17	0.72
5. Introjected motivation	0.10*	−0.09*	0.55*	0.46*	–			3.11	1.09
6. External regulation	0.00	0.08*	0.07	0.46*	0.31*	–		4.20	0.70
7. Intelligence malleability	0.15*	−0.05	0.07	−0.05	−0.08	−0.19*	–	3.96	1.65
8. School persistence intentions	0.25*	−0.05	0.25*	0.21*	0.10*	0.06	0.13*	0.89	0.31

* $p < 0.05$

3.2 Structural equation model analyses

In the first model, using the traditional SEM approach, an observed variable measuring a specific latent variable was only allowed to load on its respective latent variable. For example, only the four items intended to measure intrinsic motivation were allowed to load on the intrinsic motivation factor. Academic achievement, gender and intelligence malleability were considered to be exogenous variables. Intrinsic motivation, identified regulation, introjected regulation, and external regulation were considered to be mediators, whereas school persistence intentions were considered to be the endogenous variable. Figure 1 shows the structural part of this model. For the sake of clarity, covariances among variables are not depicted. However, covariances were freed among the exogenous variables and among the residual errors of the mediator latent constructs. This first model failed the Chi-square test ($\chi^2_{77} = 372.7,\ p < 0.01$), and showed slightly disappointing approximate fit indices (RMSEA $= 0.07$, CFI $= 0.94$).

The second model, using the ESEM approach, allows all observed variables intended to measure a type of motivation to load on all motivation latent variables. Therefore, each of the four motivation latent variables was now considered to be measured by all of the sixteen motivational indicators. However, persistence intentions and intelligence theory items were constrained to load only on their respective latent variable. Using the ESEM approach, we obtained a quite better fitting model. This model failed the Chi-square test of fit ($\chi^2_{69} = 170.8,\ p < 0.01$), but provided very good approximate fit indices (RMSEA $= 0.04$, CFI $= 0.98$). Even though cross-loadings are allowed in this model, motivation latent variables keep a clear interpretation. For example, items meant to measure intrinsic motivation load strongly on only one of the four factors, while loading weakly on the other three factors (note that some of these cross-loadings were significant). This factor, on which intrinsic motivation items load strongly, can therefore be clearly interpreted as an intrinsic motivation latent variable. Since the model using this ESEM approach provides better fit to the data, the interpretations of the results are based on this model.

Completely standardized estimates of the path coefficients are depicted in Fig. 2. For the sake of clarity, standardized path coefficients that are not significant at $p = 0.05$ are not depicted. Note that the variables considered in this model explain 33 % of the variation in school persistence intentions. Results provide only partial support to the hypothesized mediation model.

First, it was hypothesized that intrinsic motivation and identified regulation would be positively related to school persistence intentions, whereas introjected and external regulation would be negatively associated to school persistence intentions. However, out of the four motivation variables, only intrinsic motivation was found to have a significant relation with school persistence intentions ($\beta = 0.35$).

Furthermore, a significant direct relation connecting intelligence malleability to school persistence intentions was obtained ($\beta = 0.16$). However, out of the four motivation variables, only intelligence malleability has a significant relation with introjected and external regulation ($\beta = -0.12$ and -0.29, respectively). Since these two motivational variables have no significant relation with school persistence intentions, the indirect path connecting intelligence malleability to school persistence intentions is

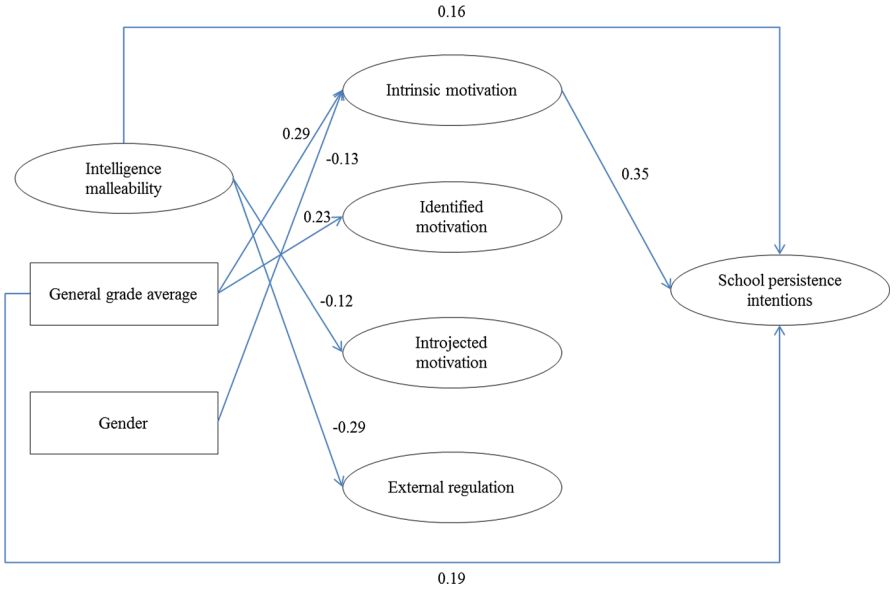

Fig. 2 Results of the model. *Note* All path coefficients are significant at $p < 0.05$. Nonsignificant path coefficients are not depicted

weak ($\beta = 0.01$, not shown on Fig. 2), and the total effect is similar to the direct effect ($\beta = 0.17$, not shown on Fig. 2). These results provide no support for the hypothesized mediation process linking intelligence malleability to school persistence intentions through the types of motivation. Thus, higher levels of intelligence malleability are directly associated with higher levels of school persistence intentions, but not through the relations with types of motivation.

Academic achievement was significantly and directly related to school persistence intentions ($\beta = 0.19$). It was also significantly related to intrinsic motivation and identified regulation. Because intrinsic motivation was significantly related to school persistence intentions, it is expected that academic achievement will have a significant indirect relation with school persistence intentions ($\beta = 0.14$, not shown on Fig. 2) in addition to its direct relation. The total effect of academic achievement on school persistence intentions ($\beta = 0.32$, not shown on Fig. 2) is thus stronger than both its direct and its indirect effects on school persistence intentions. The process linking academic achievement to school persistence intentions is therefore, both direct and mediated by intrinsic motivation.

Finally, gender was not significantly and directly related to school persistence intentions. However, gender was significantly related to intrinsic motivation ($\beta = -0.13$). Despite this significant relation, gender does not have a significant indirect effect on school persistence intentions ($\beta = 0.03$, not shown on Fig. 2). In fact, the significant indirect effect of gender on school persistence intentions through intrinsic motivation is canceled by the three other non-significant indirect effects of gender on identified, introjected, and external regulation. Furthermore, the total effect of gender on school persistence intentions is small and non-significant

($\beta = 0.02$, not shown on Fig. 2). Therefore, when controlling for intelligence malleability and general grade average, gender has little relation with school persistence intentions.

4 Discussion

The purpose of this study was to test a mediation model using ESEM in which the relation between self-theories of intelligence and persistence intentions is mediated by intrinsic, identified, introjected, and external types of motivation. Contrary to our expectations, the results of the ESEM analyses showed that the types of motivation do not act as mediators between self-theories of intelligence and school persistence intentions. Rather, the results indicate that students who hold an incremental theory of intelligence directly report greater school persistence intentions, as well as those who are intrinsically motivated thereby supporting an additive model. In addition, we found that students who succeed academically are more likely to want to continue their schooling. No gender differences were observed in school persistence intentions, though a significant effect of gender on intrinsic motivation was obtained. Below, we discuss the theoretical and practical implications of these results, as well as the limits of the present study.

4.1 Theoretical implications

First, this study is the first to explore the linkages between implicit theories of intelligence and school persistence intentions, as well as the motivational processes underlying these relations. Our study also adds to previous research on self-theories and persistence, which have focused mainly on measuring individuals' persistence on a specific task. More importantly, our study puts together two theoretical frameworks in an attempt to better understand the phenomenon of school persistence. Dweck's model postulates that differences in beliefs about the nature of intelligence can lead to the formation of goals, which result in different patterns of motivation and persistence intentions. In a similar vein, SDT posits that autonomous motivation is associated with positive outcomes such as school persistence (Vallerand et al. 1997). But how can we explain relations among these constructs? In this study we have found that self-theories and types of regulation are two independent processes that explain persistence in an additive way and not in a mediation sequence as initially hypothesized.

Second, why did some types of motivation not mediate the relations between self-theories and persistence intentions? Is it possible that some key mediators would be important to consider in the investigation of the relation between self-theories of intelligence and types of motivation proposed by SDT? Specifically, performance goals are based on the demonstration of one's ability in comparison to others, whereas mastery goals focus on the improvement of one's ability. Studies in the sport domain have revealed that autonomous motivation for sport activities is associated with mastery goals, whereas controlled forms of motivation are related to the pursuit of performance goals (Ntoumanis 2001; Standage et al. 2003; Vansteenkiste et al. 2010). These differ-

ences in the types of goals can be traced back to students' beliefs in the malleability or the fixedness of intelligence (Dweck and Master 2009). In light of these findings, it would be interesting for future research to test the following sequence: self-theories of intelligence → achievement goals (performance, mastery) → autonomous versus controlled motivations → persistence intentions.

Third, one may find surprising, in light of past research, that identified regulation, introjected regulation, and external regulation were not associated with persistence intentions. Indeed, Vallerand et al. (1997) have shown that dropout versus persistent students are less regulated by identification and by introjection, but are equivalent on external regulation (see also, Vallerand and Bissonnette 1992). Similarly, (Ratelle et al. 2007) showed that college students with an autonomous profile (high intrinsic and identified regulation, but low introjected and external regulation, as well as low amotivation) are more likely to persist. However, these past studies have not used the same statistical procedure used in this study (ESEM approach). Specifically, ESEM offers the possibility to take into account all cross-loading thereby attenuating relations among constructs (Marsh et al. 2009).

Fourth, consistent with previous research, we found that better academic achievement was associated with greater persistence intentions (Battin-Pearson et al. 2000). Interestingly, however, no significant effect of gender on school persistence intentions was observed. In most studies, girls are generally less likely to dropout than boys (Vallerand and Bissonnette 1992; Vallerand et al. 1997). One factor that could possibly account for these divergent findings may be that students' intentions to persist were measured, whereas in the literature, this gender difference is generally found relative to the actual dropout behaviour (Vallerand and Bissonnette 1992; Vallerand et al. 1997). Another factor that may be put forward is that the school attended by the participants in our study stands in the upper range for SES (MELS 2010). Being part of an environment where school achievement is valued, males and females may therefore be equally likely to show a desire to persist in school. Indeed, some research has shown that the gap between boys and girls who obtain a high school diploma increases as the SES factor declines, with boys being more likely to dropout than girls (MELS 2005). Without neglecting the importance of other variables (e.g., individual characteristics, psychological and behavioural measures), more research for males and females are still needed to verify this hypothesis and provide further insight to our understanding of school persistence intentions.

4.2 Advantages of ESEM

In this investigation, we used ESEM to test the proposed model. As argued in the introduction, by estimating all cross-loadings between indicators and latent motivational constructs, ESEM allowed us to overcome the limitations of SEM in terms of overestimated path coefficients among latent constructs. With ESEM, cross-loadings between intrinsic motivation (IM) and types of extrinsic motivation (EM) indicators were consistent with theoretical expectations. Most importantly, these results are in line with those from previous ESEM studies in showing the importance of regularly comparing ESEM and CFA solutions (Marsh et al. 2011; Morin et al. 2013). In the

present study, without the ESEM comparison, the results would have led us to retain the SEM solution, thus missing the improved fit of the ESEM solution, but also the more accurate estimates of the ESEM model.

4.3 Practical implications

The present research has significant implications for educators, parents and teachers. Particularly, it is important to promote the development of intrinsic motivation at school by creating the conditions that foster pleasure and satisfaction at school. Parents and teachers should try to decrease the emphasis on extrinsic motives to do well in school and instead try to nurture students' personal interest in learning, as well as highlight the opportunities for personal meaning. Many studies have revealed that the use of external incentives such as evaluation, surveillance, competition, threats of punishment, negative performance feedback and the promise of rewards, decreases students' intrinsic motivation (Deci and Ryan 2010). These extrinsic motives often serve to control people's behavior and get them to perform an activity, but in the long run, people tend to lose interest and quit. On the other hand, factors such as acknowledging feelings, providing choices and giving positive performance feedback contribute to enhance students' intrinsic motivation, resulting in better academic achievement and greater persistence (Deci and Ryan 2010).

It is also equally important to develop in students a malleable theory of intelligence. Even though implicit theories are relatively stable over time (Robins and Pals 2002), there is evidence that they can be altered through interventions (Aronson et al. 2002; Blackwell et al. 2007; Good et al. 2003), which underscores the dynamic structure of these motivation-based systems. For instance, in an intervention study, Dweck and her colleagues taught one group of seventh graders, the "growth mindset group", how they can grow their intelligence and how the brain develops like a muscle. The control group, on the other hand, was taught eight sessions of study skills. The growth mindset group showed a significant improvement in their math grades, whereas the control group showed no progress and continued to decline (Blackwell et al. 2007). Furthermore, the students in the growth mindset group showed greater engagement and put more effort into their schoolwork and learning.

4.4 Limitations

When interpreting the results of this study, certain limitations need to be considered. First, we relied on self-report measures of intentions to drop out of high school. Even though Vallerand et al. (1997) previously pointed out that dropout intentions are reliable predictors of dropout behavior, it would be important for future research to supplement intentions with objective dropout rates. Second, our sample was composed of mainly white males and females from an upper-class area in suburban Montreal. Our results may therefore not be representative of the general population. Also, it is impossible to infer causality relations among the findings. Future research should therefore replicate this study using a longitudinal design in order to increase the validity

of the results. Lastly, since Dweck's self-theories can be measured within particular domains (Dweck et al. 1995; Dweck and Master 2009), it would be interesting to test this model at the domain-specific level (e.g., mathematics, writing, reading).

5 Conclusion

This study examined the relations between theories of intelligence, types of academic motivation, and school persistence intentions. Our findings suggested that types of academic motivation do not mediate the relation between theories of intelligence and school persistence intentions. Rather, we observed that incremental intelligence beliefs and intrinsic academic motivation are independently associated with school persistence intentions. We have shown how these findings have theoretical as well as practical implications. Without denying the influence of other environmental factors such as family and friends, our results demonstrate how holding an incremental theory of intelligence and being motivated in an intrinsic fashion can be beneficial for students' persistence intentions. In conclusion, promoting incremental intelligence beliefs and intrinsic motivation in students may be an important step that facilitates school persistence beliefs that might indirectly help some OECD countries to reduce their dropout rates.

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